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SOME EVIDENCE ON NON-VOTING MODELS IN THE SPATIAL THEORY OF ELECTORAL COMPETITION

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The multidimensional spatial theory of electoral competition introduced by Davis and Hinich has been expanded to include forms of citizen non-voting which depend on the positions of the candidates.[1] Spatial theory rests on the key assumptions that voters share a common coherent perceptual spatial framework for candidates, and that the indifference contours of a voter's utility function are ellipsoids. If the ellipsoidal indifference contours have the same alignment, these assumptions imply that choice can be rationalized by simple Euclidean distance. In a more general spatial model, weights on the dimensions of the space vary in the population.

The dimensions are described as salient political issues in previous expositions of the theory, but it is more consistent with empirical studies of voter attitudes to conceive of the dimensions as heuristic factors which are used by a voter to forecast a candidate's behavior with respect to economic and social policy once elected to office.[2] It is rational for a voter to simplify the evaluation process by reducing the complexity of the issue space. Since the choice is over representatives and not issues per se, a rational voter must forecast how a candidate will behave in office. It is reasonable to use past performance and past associations as a guide to a candidate's future behavior. Moreover most voters do not have much incentive to invest in information, given the small impact of a single vote and the infrequency of elections. Thus a simple rule of thumb based on inexpensive but noisy information is the best evaluation and choice strategy for most voters and even modest contributors.

To be more specific about spatial theory, assume there exists a <u>cardinally</u> defined issue space common to all citizens and that individual preferences can be represented by the weighted Euclidean distance metric:

$$\| \underset{\sim}{\theta}_j - \underset{\sim}{x}_r \|_A^{2/k} = [(\underset{\sim}{\theta}_j - \underset{\sim}{x}_r)]^{1/k}$$

$$= \left[\sum_{i=1}^{n} \sum_{h=1}^{n} a_{ih}(\theta_{ji} - x_{ri})\ (\theta_{jh} - x_{rh})\right]^{1/k}$$

where $\underset{\sim}{\theta}_j = (\theta_{j1}, \ldots, \theta_{jn})'$ denotes the <u>position of candidate</u> on each of <u>n dimensions</u>, $\underset{\sim}{x}_r = (x_{r1}, \ldots, x_{rn})'$ denotes the rth citizen's <u>ideal point</u>, and $\underset{\sim}{A} = (a_{ih})$ is a positive definite nxm matrix of <u>factor weights</u>. The usual assumption of spatial

theory is that k=1, i.e., if we interpret $-\| \underset{\sim}{\theta}_j - x_r \|_A^2$ as a utility function, then utility is inversely measured by squared distance. The assumption of a common cardinal space, however, is problematic since the factors typically possess no natural scale. Thus, citizens may define the space with a particular sensitivity to positions that are "far" from their ideal points or alternatively they may be sensitive, i.e., perceive differences as substantively meaningful, only if positions are "near" their ideal points. To accommodate the several possibilities, k is allowed to vary. If k=1 each citizen is more sensitive to positions that are far from $\underset{\sim}{x}_r$ If k=2, citizens' sensitivity is uniform. If k=4, citizens are more cognizant of differences near their ideal points. For a given population, k is a parameter that must be estimated.

1. DEVELOPMENT OF A SPATIAL METHODOLOGY

Two special statistical methodologies have been developed to test spatial theory using candidate feeling thermometer scores gathered by the University of Michigan Survey Research Center; namely the methods of Cahoon, Hinich, and Ordeshook [2] and Rabinowitz [9]. Suppose now that N respondents rate each of p + 1 national political figures on a thermometer scale (that varies from 0 to 100), where the number of candidates exceeds the number of issues (p > n), and the rth respondent's thermometer score for candidate j takes the form

$$T_{jr} = 100 - [(\underset{\sim}{\theta}_j - \underset{\sim}{x}_r)' A(\underset{\sim}{\theta}_j - \underset{\sim}{x}_r)]^{1/k} + \varepsilon_{jr} \qquad (1)$$

and where ε_{jr} is a stochastic error term. The CHO uses the model (1) to map candidates and respondents in a common space for the 1968 survey.

Assuming that the thermometer scores is given by (1) for each respondent in a sample of the electorate, the CHO goal is to identify (estimate) the dimensionality of the issue space, n, each candidate's position in the space, $\underset{\sim}{\theta}_j$, each citizen's ideal point, $\underset{\sim}{x}_r$, and the matrix of issue weights, $\underset{\sim}{A}$. The CHO method, in a nutshell, approximately modifies the data (thermometer scores) and applies the principal components version of factor analysis. That this data must be modified in some way follows from the fact that factor analysis assumes a linear model whereas the model of expression (1) is non-linear (owing to the term $\underset{\sim}{x}_r'\underset{\sim}{A}\underset{\sim}{x}_r$). In addition to the spatial model itself, the basis assumptions underlying the method are: (1) all citizens have the same perception of each candidate; and (2) <u>each a_{ih} varies independently of $\underset{\sim}{x}_r$ in the population</u>, e.g., all citizens weight the factors in an identical fashion. Clearly, these two assumptions, while implicit in metric scaling techniques and while possessing a long history in spatial analysis, are restrictive. Without the assumption of some structure, however, estimation is impossible. As a partial resolution of the problem, then, when analyzing the SRC thermometer data they divide the sample by partisian identification to demonstrate that there are no significant differences in the candidate maps. Of course, there are many interesting partitions of the sample which could be analyzed using the methodology.[3]

2. EMPIRICAL ANALYSIS OF NON-VOTING

Now let us apply this method to the spatial theory of non-voting. The feeling thermometer scores from the 1968 election survey were used by CHO to estimate a joint space containing politicians and respondents. As is discussed in detail in their paper, the data supported an assumption that the space had two-dimensional with a third valence dimension for the less well-know politicians. Weighted Euclidean distances from the respondents to Nixon and were calculated from this space for example for Nixon and the r^{th} respondent. The distance is given by

$$[a_1(\theta_{N1} - x_{r1})^2 + a_2(\theta_{N2} - x_{r2})^2]^{1/2}, \qquad (2)$$

where a_1 and a_2 are dimension salience weights, θ_{N1} and θ_{N2} are Nixon's position coordinates as calculated from the data, and x_{r1} and x_{r2} are the estimated ideal point coordinates. The salience weights are assumed to be positive and the same for all respondents in a given group. These computed distances are highly correlated with the raw thermometer scores. Except for setting the cross weight $a_{12} = 0$, CHO fits the parameters of the basic spatial model with its perceptual assumptions.

The estimated ideal points for the Republican identifiers and nonvoters are shown in Figures 1 and 2, where the coordinates have been adjusted by the salience weights so that any distance between points in these figures is <u>simple Euclidean distance</u>. As a consequence, all the ideal points which are closer to Nixon in Figure 1 should prefer Nixon to Humphrey and vice-versa. For Republican identifiers who stated they voted, such a decision rule gave a 95.9

percent correct prediction rate. Moreover the estimated ideal points were consistent with the scores on various issue questions, as is discussed in detail in the cited paper, and therefore there is evidence for assuming that the ideal point and candidate map is worth using here.

Not all the respondents were mapped in the space. Since it was theoretically important that the respondents were politically aware, respondents who did not score all the twelve politicians named were removed from sample. In addition, respondents who gave a score of 50° to four or more politicians were removed since an analysis of the raw scores indicated a confounding between a response of 50° and "don't know." Table 1 shows the difference between the total and subsample income and education distributions, and also gives the breakdown of reported voting statistics for the two groups. The fact that we are analyzing a subsample of the respondents who are of higher income and education than the total does not invalidate the results since the aim of the research is to demonstrate the applicability of the spatial model to predicting choice by voters who have some political awareness, and not to predict the outcome of a given contest which can be better accomplished using paired comparison data.

The subsample was divided into three groups. The first group consisted of those respondents who identified themselves as strong Democrats, weak Democrats, or Independents who leaned toward the Democrats. This latter group was included since a review of the data indicated that their preferences were strongly Democratic.

The second group consisted of the strong and weak Republican identifiers, and Independents who leaned toward the Republicans. The third group consisted of all the Independents, and thus this group overlapped with the other two.[4] Very similar maps were obtained using only strong and weak Republicans, but the larger sample size gave better fits.

Hinich and Ordeshook suggest two models for abstention; alienation and indifference. If voters abstain because of alienation, then the average distance to the closest of the two candidates should be <u>larger</u> for the <u>nonvoters</u> than the voters.[5] If the abstention is due to indifference, the average absolute difference in the two distances should be <u>smaller</u> for the nonvoters than the voters.[6]

The "distances" to Nixon and Humphrey were calculated for each respondent. The mean and standard deviations of the minimum distance, difference in distances, income, and educational level for the Republicans is shown in Table 2. The indifference hypothesis is sustained but <u>alienation is not</u>. The univariate F-ratios and the within-groups correlation matrix used in a discriminant analysis approach is given in Table 3.[7] The income variable is highly significant and the difference in distances variable is significant at the 0.05 level assuming a $F(1,242)$ distribution. The <u>minimum distance is</u> insignificant. The education variable is almost 0.05 significant. Thus the abstention from indifference model seems to hold some promise for predicting nonvoting, but the <u>alienation model is rejected for this data base</u>, although, Rosenthal and Sen show it is of significance for predicting a type of abstention in voting for the French Assembly.[8]

The educational level is scored from one to five: 1 -- elementary or no schooling, 2 -- high school, 3 -- high school plus trade school, 4 -- college and 5 -- post graduate. With this coding the correlation between income and education is only 0.29. The negative 0.21 correlation between education and minimum distance shows that the respondents whose ideal points are extreme tend to have lower education. This correlation is due to the way ideal points are estimated. If a respondent gives one politician a much higher score than another when most of the group give them similar scores, then the respondent's ideal point is located towards the fringe of the space by the procedure. Socially conservative Republicans with low education gave Rockefeller much lower scores than the rest of the Republicans.

As a more "sophisticated" statistical test, a Bayesian discriminant analysis[9] was performed on the Republican voters and nonvoters using a $p_1=0.5$ and the "natural" prior for nonvoting $p_1 = 31/244$. For $p_1 = 0.5$, out of the 31 nonvoters 20 were classified correctly and 11 were not. Of the 213 voters, 130 were classified correctly and 83 were not. The overall percent correctly classified was 61.5 percent.

When $p_1=0.127$ was used, all Republicans were classified as voters. Thus the 31 nonvoters were misclassified but the overall percent correctly classified was 87.3 percent. Even when p_1 was increased to 0.25, all Republicans were classified as voters. Even though income and indifference were significant, the large proportion of voters in the sample dominated the classification.

The indifference model was not significant for the Democrats where the F-ratio for Diffdist was a mere 0.29 with 39 nonvoters out of 317. Even the income variable had a meager F-ratio of 3.26 but the difference in means had the correct sign, since the mean income of voters was $9,332 whereas the mean for the nonvoters was $7,666. The mean difference in distances for the voters was 0.59 which is less than the mean of 0.62 for the nonvoters. The Independents showed a weak indifference effect which was barely significant for the raw scores but statistically insignificant for the computed distances.

The within-groups correlation matrix for the Democrats and Independents was roughly the same as for the Republicans, but the negative correlation between education and the minimum distance was insignificant.

As a check, I computed the mean and standard error of the difference between the thermometer scores of Nixon and Humphrey for the Republican voters and nonvoters. The mean difference for the voters is 38 with a standard error of 4.7. The mean difference for the nonvoters is 27 with a standard error of 4.4. The difference of 11 is statistically significant. On the other hand, both groups had a mean maximum score of 84, reinforcing the hypothesis that the alienation effect is negligable or non-existent.

For the whole sample all that we can say is that the higher income people tend to be more likely to vote and that the abstention from alienation model can be rejected for the 1968 election survey.

Table 1
INCOME DISTRIBUTION OF RESPONDENTS

Income	Percent of Population Sample in Each Income Group	Percent of Subsample in Each Income Group
Less than $1,999	9.0	4.2
$2,000-3,999	14.2	10.4
$4,000-5,999	13.4	11.1
$6,000-7,999	18.4	19.6
$8,000-9,999	13.0	16.3
$10,000-11,999	11.1	11.9
$12,000-14,999	9.5	12.2
$15,000-19,999	6.0	7.0
$20,000-24,999	2.0	2.6
$25,000 or more	3.3	4.6

EDUCATIONAL LEVELS OF RESPONDENTS

Education Level	Percent of Population Sample in Each Educational Group	Percent of Subsample in Each Educational Group
Eight Grades or less	21.3	13.1
Between Eight and Twelve	40.0	35.2
Some or all of college	34.6	45.3
Advanced Degrees	4.1	6.5

Table 1 (Continued)

NON-VOTING

	Population Sample	Subsample
Voted	75.8%	86.5%
Abstained	24.2%	13.5%

Table 2
REPUBLICAN VOTER AND NON-VOTER STATISTICS
MEANS

	Non-Voters	Voters	Total
Number	31	213	244
Mindist	1.64	2.16	2.09
Diffdist	0.54	0.77	0.74
Income	6,664	10,907	10,368
Educ	2.84	3.24	3.19

STANDARD DEVIATIONS

	Non-Voters	Voters	Total
Mindist	1.14	2.11	2.02
Diffdist	0.52	0.60	0.59
Income	4,151	6,563	6,458
Educ	1.07	1.06	1.07

Table 3
REPUBLICAN DISCRIMINANT STATISTICS

F-ratios

Mindist	Diffdist	Income
1.80	4.18	12.22

WITHIN-GROUPS CORRELATION MATRIX

Mindist	1.00		
Diffdist	0.22	1.00	
Income	-0.02	-0.01	1.00
Educ	-0.21	0.09	0.29
	Mindist	Diffdist	Income

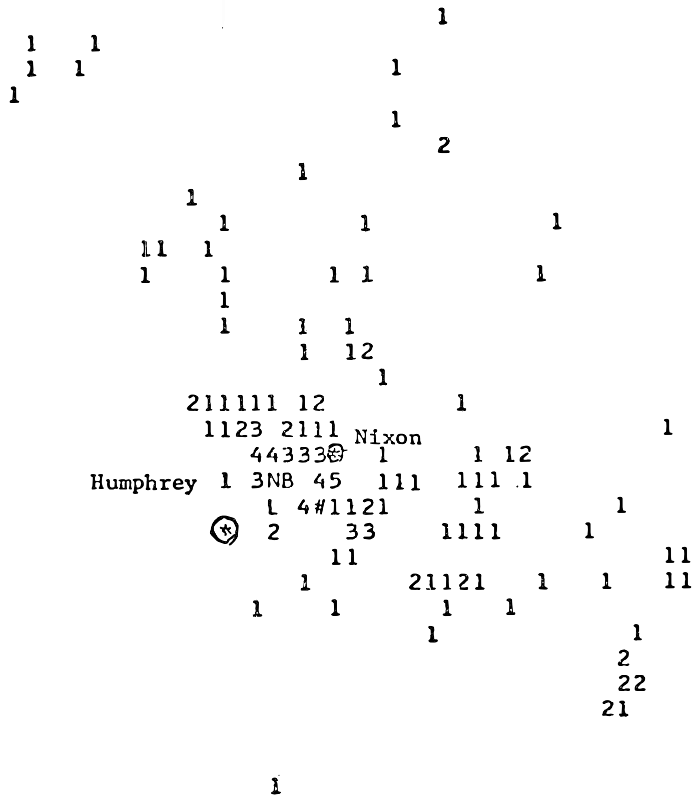
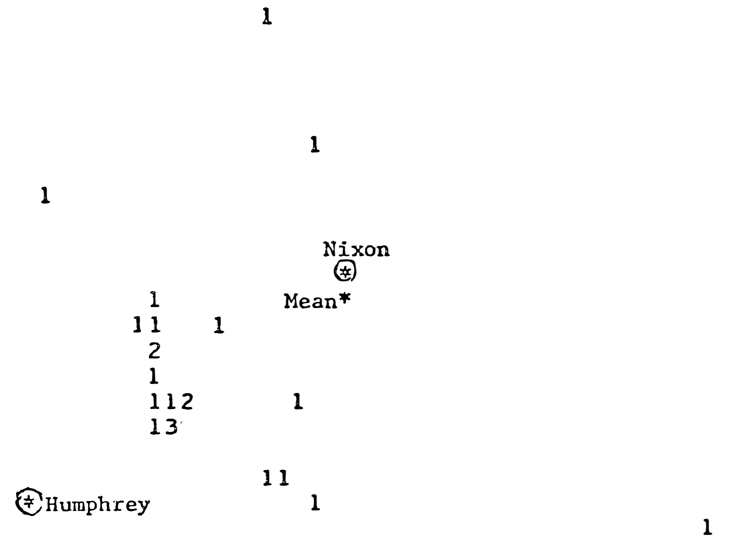


FIGURE 1

Distribution of Republican Ideal Points

= 10, A = 11, B = 12, etc.



(Due to size of plot, the positions of six citizens have not been plotted.)

Mean denotes average ideal point for Republicans

FIGURE 2

Republicans 1968: Nonvoters

FOOTNOTES

1. Spatial theory is an extension and formalization of the pioneering ideas of Downs [5] and Black [1]. For a review of spatial theory, see Davis, Hinich, and Ordeshook [4].

2. The connection between issues and dimensions is discussed in the spatial analysis of the candidate feeling thermometer scores from the 1968 election survey by Cahoon, Hinich, and Ordeshook [2]. Also see Rabinowitz [9] and Rusk and Weisberg [11].

3. The methodology and its application to the 1968 survey is summarized in Cahoon, Hinich, and Ordeshook [2]. The details of the statistical methodology are present in the PhD thesis of Lawrence Cahoon, Statistics Department, Carnegie-Mellon University, (July 1975).

4. The blacks were deleted, however, from the Democrats and Independents since they gave Robert Kennedy much higher scores than the whites and thus it seemed that they should be treated as a special group (only one black identified with the Republicans). Unfortunately, there were not enough blacks in the sample to sustain a spatial analysis.

5. Using an indirect approach, Page and Brody [8] show some positive support for the indifference model in 1968, but there is some question about their interpretation of the formal definition. In any event, the effect on turnout of the candidates' positions is very weak if it exists.

6. This definition of indifference also captures the cross-pressure phenomenon. See Hinich and Ordeshook [6].

7. The F-distribution is valid for these ratios if the data came from a multivariate normal distribution. However, the income distribution is non-normal. I tried a logarithmic transformation on the incomes to reduce the effect of large incomes and obtained similar F-ratios. Given the sample size, and the invariance of the results using the logs, the F-ratios suggest the true magnitude of the importance of the individual variables.

8. See Rosenthal and Sen [10].

9. See Johnston, Econometric Methods, (2nd edition), 336 [7].

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